The Synergy of On-Farm-Tests and Small Plot Research in Managing Nitrogen for Wheat Yield and Protein

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Background

Manitoba farmers are growing new varieties of spring wheat with very high yield potential (80-100 bu/ac) but often produce protein less than thresholds (ie 13.5%) accepted for milling wheat prices. This brings challenges in nitrogen (N) management:

- current N recommendations suffice for yields as high as 65 bu/ac
- A guideline of 2.5 lb of soil & fertilizer N/ bu translates to a 200 lb N supply/ac for 80 bu crops – greatly exceeding traditional rates and representing a large financial risk to growers, and risk of excessive lodging and N losses to the environment
- Mid-season nitrogen applications may be considered a strategy for meeting yield and protein.

Researchers using traditional small plots teamed with interested farmers and agronomists using on-farm-testing (OFT) techniques of field scale replicated field strips (Figure 1)

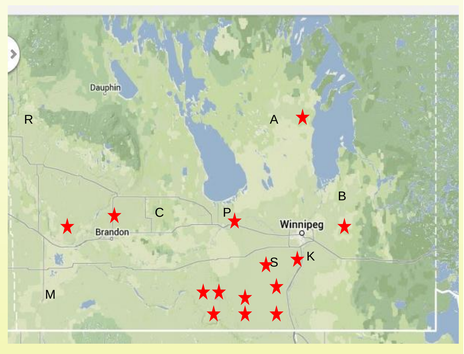

Figure 1. Manitoba locations of research stations (letters) and OFT sites (stars).

Of some 18 research plot treatments, several were common to the OFTs:

1. Adding 30 and 60 lb N/ac above the farmer's standard base N rate (base rate for research plots was 130 lb soil & fertilizer N/ac)
2. Post anthesis N (PAN): a foliar application of UAN solution (28-0-0) at 30 lb N/ac, diluted 50:50 with water, applied approximately one week after flowering on top of the base N rate.

OFT strips were replicated 3-5 times and yields were determined with yield monitor equipped combines or weigh wagons. Protein was measured at local elevators. Data was analysed using ANOVA.

Project contributors included: Richardson Pioneer, Farmers Edge Laboratories, KOCH Fertilizers, Manitoba Wheat and Barley Growers Association, Antara Research, Agritruth, MAFRD research and extension staff, AAFC-Portage, Kelburn Farm and Manitoba farmers

Methods

Figure 2. Post anthesis N application in small plots (above) and in fields.

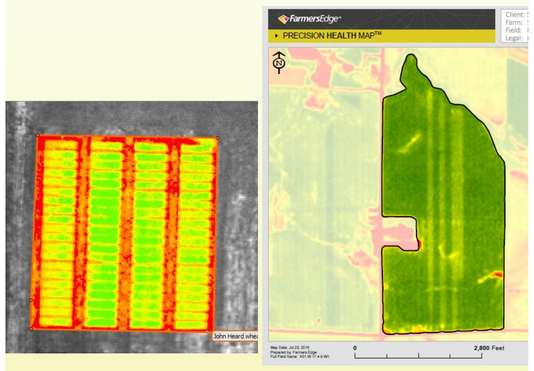

Figure 3. Aerial imagery of small plot N trials with 18 tmts and 4 replicates (left) and field strips of PAN tmt replicated 3 times (right).

Observations

Fig. 4. Lodging near anthesis reduced yield potential at several sites.

Fig. 5. Flag leaf scorch injury from the post anthesis N treatment was severe due to hot, humid conditions in 2015.

Observations

Yield potential was respectable in 2015, but less than farmers have experienced in recent years. Yield limiting events included a late spring frost, severe lodging after heading and high temperatures during anthesis. Consequently protein levels were generally high in 2015.

1. Base N rates & 30 or 60: There was minimal yield response to increased N rates with slightly more frequent response in protein (Figure 6). In most cases the base N treatment was adequate to meet 2015 yield potential and protein.

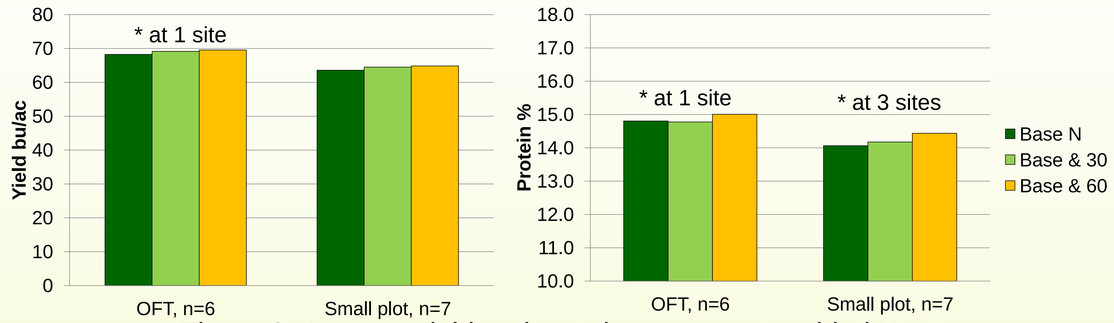

Figure 6. Average yield and protein response to added N rates.

* indicates a significant difference (P<0.05).

2. Post anthesis N: In spite of severe flag leaf scorch, averaging 15%, yield reduction was significant in only 2 cases (Figure 7). The average lb fertilizer & soil N/bu was 2.16 for OFT and 2.09 for small plots, but varied widely.

Figure 7. Yield response to post anthesis N application.

***** over columns indicates a significant difference (P<0.05).

PAN significantly increased protein half the time (Figure 8), however this $24/ac treatment was not profitable with current protein premiums ($0.10 per % point protein vs $0.30 in 2014).

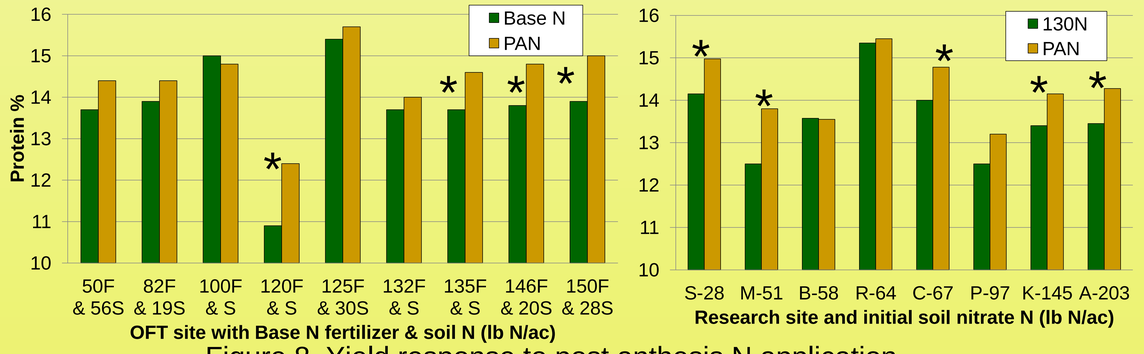

Figure 8. Yield response to post anthesis N application.

***** over columns indicates a significant difference (P<0.05)

Summary: On-farm-test results compliment traditional research results well. Farmers are keen to continue with such research to fine tune N management.